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The Effect of Fire Frequency on the Presence of Native and Nonnative Species in the Santa Monica Mountains

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Bobby Boss, Simone Ross, Taryn Thompson, Pepperdine University, Malibu, CA 90265

Abstract:

We surveyed two sites in the Santa Monica Mountains of Southern California that experienced both high and low fire frequency (Figure 1). Our objective was to find out if increased fire frequency allowed for the invasion of non-native species. We collected data on herbaceous coverage and point to plant distance of woody chaparral species. A series of random points were used, and each area was divided up into four equal quadrants using two meter sticks. The individual nearest to the center in each quadrant was then identified and measured. To measure herbaceous coverage, percentages were took of cover of each species within a square area and assigned a number (1=0-25%, 2=25-50%, 3=50-75%, 4=75-100%). We hypothesized that high fire frequency would increase the coverage of non-native species. We found that in the areas of high fire frequency, native chaparral shrubs were less frequent averaging about one shrub every 40m2, and in the low fire frequency, the native chaparral shrubs were more frequent averaging about one shrub every 1m^2. For the herbaceous species, we found that in the high fire frequency sites there was 100% native species cover, and in the low fire frequency sites there was a 69% native species cover. This disproves our hypothesis and shows that high fire frequency does not necessarily allow for the invasion of non-native species.

Figure 1: Malibu Canyon Study Site

Introduction:

The Santa Monica Mountain Range is located in the heart of Southern California surrounded by the sprawl of Los Angeles. With its unique location and population of chaparral species, fire is a key factor influencing the ecosystem. Brushfires commonly occur during the fall when Santa Ana winds blow the strongest. Many of the chaparral plants are dependent on fire, for example, Big Pod Ceanothus (*Ceanothus megacarpus*).

Auto-succession describes the pattern in which the species establish themselves after a disturbance. Generally, immediately following a disturbance, in this case fire, quickly growing species dominate; such as fire annuals. As auto-succession continues, the post-fire species are replaced by competitively favored ones; such as chaparral shrubs. This auto-succession of species acts as a buffer for many communities keeping the composition of species constant, and protecting against invasive species by minimizing establishment opportunity to a short period immediately post fire. However, it is suggested that auto-succession does not characterize all post-fire chaparral communities. One factor that may influence species composition is increased fire frequency. Recently, Southern California has been subjected to an increased number of fires in a short period of time. We predict that with higher fire frequencies chaparral communities will not follow auto-succession but will be more easily invaded, therefore changing the species composition of those communities.

Materials and Methods:

A series of random points were chosen by throwing a rock behind our head. Each area was divided up into four equal quadrants using two meter sticks. The individual nearest to the center in each quadrant was then identified and measured (distance from center, canopy, base and height) (Figure 2). To measure herbaceous coverage, percentages were took of cover of each species within a square area and assigned a number (1=0-25%, 2=25-50%, 3=50-75%, 4=75-100%) (see Figure 3). (Cox 1985)

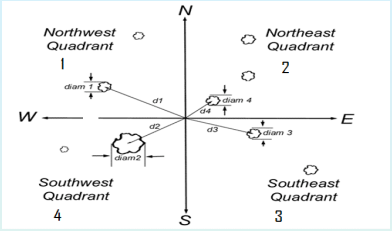


Figure 2: Diagram of Point-Quadrant Sampling method.

Figure 3: Taryn Thompson measuring herbaceous coverage.

Data and Results:

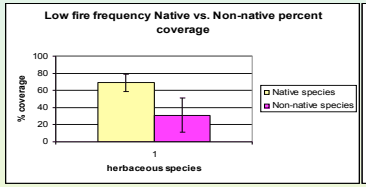
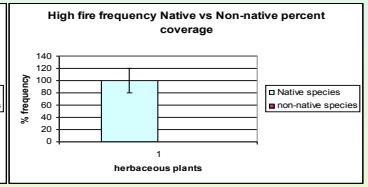


Figure 4: Shows % coverage of native and non-native herbaceous species in low fire frequency sites.



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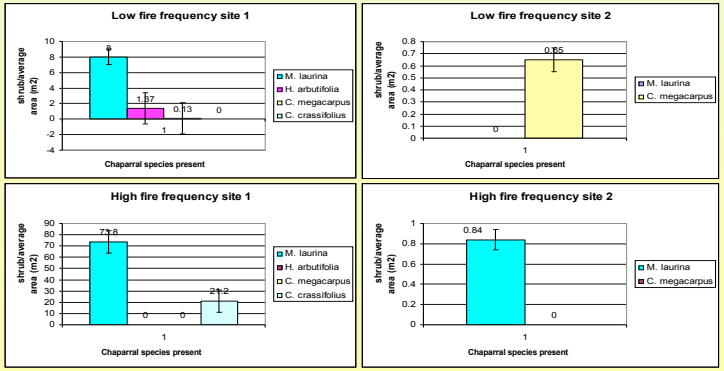

Figure 6: Compares average area (m^2) that is occupied by one chaparral species in low fire frequency sites versus high fire frequency sites.
* Species not present in sampling grid.

Conclusions:

1. High fire frequency allowed for auto-succession of native species.

2. *Malosma laurina* was the most prevalent chaparral shrub.

3. Chaparral shrubs were more frequent per area in the low fire frequency as opposed to the high fire frequency.

4. *Lupin sp.* and *Lotus salsuginoses* were the most prominent herbaceous species in the high fire frequency sites, and *Lotus salsuginoses* and *Marah macrocarpus* were the most prominent herbaceous species in the low fire frequency sites.

Literature Cited

Cox, George. 1985. *Laboratory Manual of General Ecology 5th Ed. WMC Braun Co.*

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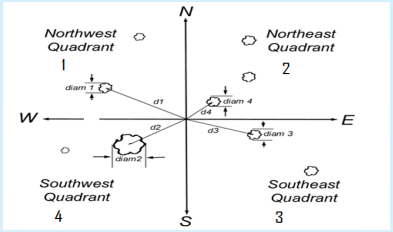

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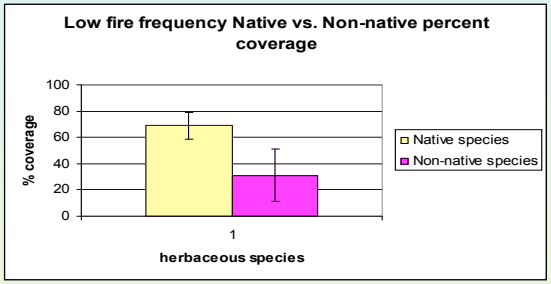

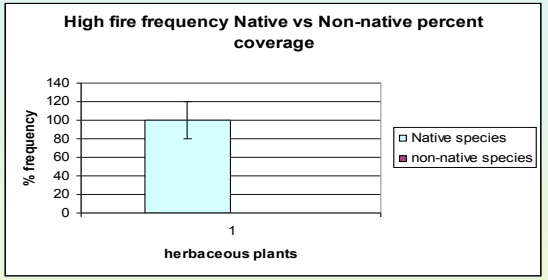

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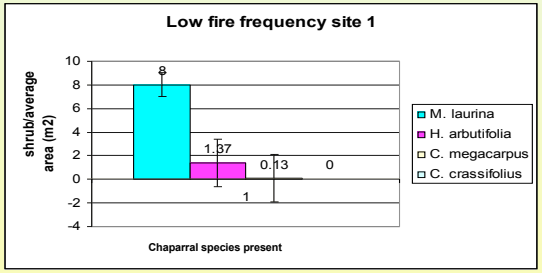

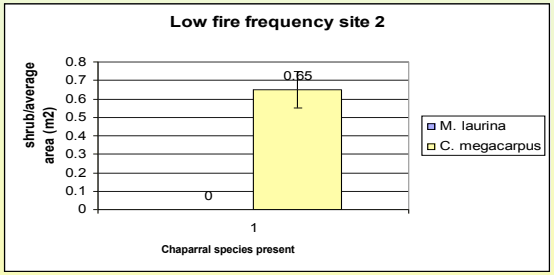

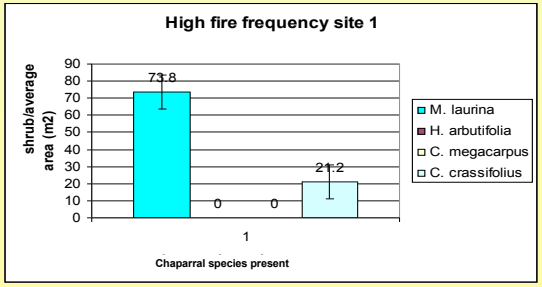

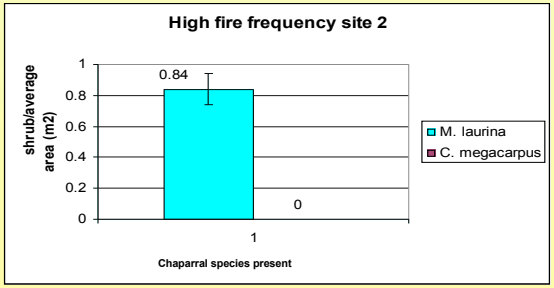

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